Association for Machines and Mechanisms News Bulletin

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Our Objectives and Activities

The main objective of AMM is to contribute to mechanical design at all levels starting from academic research to industrial initiatives, thereby enhancing the quality and reliability of indigenous machines. With this in view, AMM organises the National Conference on Machines and Mechanisms, NaCoMM, and the workshops on Industrial Problems on Machines and Mechanisms, IPRoMM.

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Message from the Editor-in-Chief

Micromechanism and Microsystem

A micromechanism consists of mechanical components with submillimeter dimensions and corresponding tolerances of the order of 1 micrometer or less. Application areas of micromechanism includes compliant micro-mechanisms for force/displacement amplification based on four bar mechanism and micro-switches using snap-action bistable mechanisms. Some motivations for development of micromechanism includes reduction of size, weight and power consumption, improvement of performance and reliability, reduction of cost, new properties and functionalities, scientific motivations for exploring smaller things and last but not the least make money.

Micropositioning mechanism is a key and essential technology in many fields, such as scanning electron microscopy (SEM), X-ray lithography, mask alignment, and micromachining. Flexure hinge has been commonly used as a substitute for mechanical joints in the design of micropositioning mechanisms.

A typical miniaturized bio-inspired robot mimicking the locomotion mechanism of earthworm based on EAP actuation is a good example of micromechanism based microsystem to navigate inside tubular structures of intricate geometry. It may be assisted with a compliant mechanism based multi-finger gripper for tool holding with added intelligence to improve performance.

Recent advances in fabrication technology make possible the synthesis of complex micromechanisms, such as gears, ratchets, and transmissions. Designers need to analyze candidate micro-mechanisms to validate correct function, to detect design flaws, and to assess the effects of part clearances. Traditional computer-aided design software is inappropriate for these tasks. Mechanical system simulators offer an efficient alternative to finite element codes, but are limited to systems with permanent part contacts, such as pin joints, prismatic joints, and involute gears. These conditions are unrealistic for micro-mechanisms because the fabrication process cannot produce ideal joints and because changing contacts play a major role in microdesign

Scaling laws are important in design and synthesis of microsystems. Scaling laws make the designers aware of the physical consequences of downscaling machines and devices. Scaling laws illustrate that shrinking a body does not only lead to size reduction but also to different modifications of physical effects. Successful design of micro machines requires a thorough understanding of scaling laws for all the subunits of the system. When designing micromechanism, the scaling effects must be taken into account. The physical laws remain the same at all scales but their significance changes drastically at different scales.

Subhasis Bhaumik
Editor-in-Chief

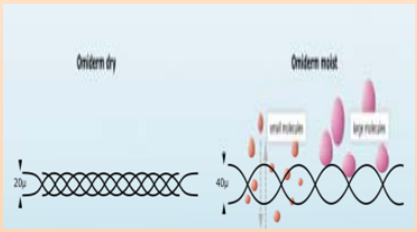
Smart Medical Bandages

Apurba Das and Riddha Das
Department of Textile Technology, IIT Delhi

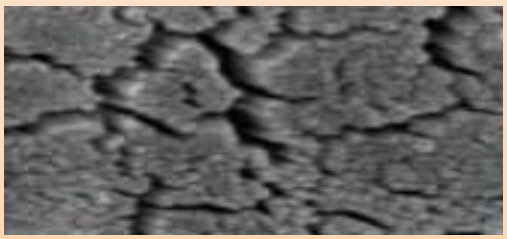
The world is moving towards a new era with smart and intelligent technology making our systems, infrastructure, and lifestyle more efficient, more productive and faster. In a word, the world is becoming smarter. Healthcare and wellbeing is one of the most important application areas of smart materials. Researches all over the world are going on to develop 'smart bandage' concept to monitor and treat different chronic wounds more precisely and more efficiently. Bandage can be defined as a strip of material used to protect, immobilize, compress, support a wound or injured body part. Bandaging is a simple procedure, but if applied incorrectly, it may lead to considerable harm, for example, by restricting movement or blood flow. There are several categories of bandage, such as retention, support and compression. Smart medical bandages can be divided in to three broad groups, (a) Smart wound dressing; (b) Smart bandage as a monitoring device; and (c) Smart compression bandage for ulcer treatment

a) Smart wound dressing: A wound can be defined as a cut or break in the continuity of any tissue, caused by injury or operation. Several smart bandages have been developed for better wound management to promote rapid wound healing. A few of the interesting works have been described below.

i) Omiderm™ dressing material: Omiderm™ is a highly permeable, transparent, flexible, non-adhesive wound dressing, based on a unique polyurethane membrane supported gel. It is chemically modified by hydrophilic monomers. In dry state the film is relatively non-elastic, but when it comes into contact with wound, it becomes highly elastic and conformable. Then small molecules like air, water vapour diffuse through openings and big molecules like protein, virus, and bacteria are extruded. This bandage is twenty times more water vapour permeable than traditional dressing. The most important part is that, as healing takes place, this dressing peels off by itself.



Omiderm™



TheraGauze™

ii) TheraGauze™ smart wound dressing: Traditional absorbent dressings are designed to absorb exudates out of the wound bed like a sponge. Unlikely, TheraGauze™ consists of a proprietary inert SMRT polymer which is integrated into a non-woven polyester/rayon substrate. SMRT (Skin Moisture Rebalancing Technology) allows TheraGauze™ to regulate moisture very precisely. During the manufacturing process, release of alcohol in a specially controlled environment creates a vertically oriented matrix of hundreds of thousands of microscopic channels that decrease in a fractal pattern and are bordered by millions of vertically oriented polymer chains. The SMRT (Skin Moisture Rebalancing Technology) TheraGauze™ polymer is also hydrated with propylene glycol (PG). As a humectant, it moderates the delivery of moisture to and from the SMRT Polymer.

b) Smart bandage as a monitoring device:

i) Optical fibre as respiratory sensor: Optical fibres are embedded into a knitted rubber fabric. Optical losses in the optical fibers are function of the radius of the fiber bending. Under mechanical stress applied to the textile material fiber loop Radius increases, which exhibits high optical power variation. This bandage can be used as a respiratory sensor.

ii) Smart bandage to test cholesterol: The smart bandage developed by Ray Winton of Mississippi State University may completely test cholesterol, insulin and blood chemistry without using needle and may also triple life charges of cell phone batteries. The main advantage of these adhesive bandages is that they do not need a battery or other on-board power source. The power source used for tiny integrated circuits to detect information like cholesterol is by picking up radio-frequency power by an antenna, making the power source virtually infinite.

c) Smart compression bandages for ulcer treatment: Chronic leg ulcer is a common health problem, for which compression therapy has been proved to be most beneficial. But, it will be effective only when the compression bandage will be applied with correct pressure. So scientists have developed smart compression bandages to increase its efficiency.

To be continued to the next issue …….

Student Column (Coordinated by Dr. Nirmal Hui, NIT Durgapur)

Automatic Tank Filling Mechanism

Tarun kumar Hazra and Swapnadip Chowdhury
Jalpaiguri Government Engineering College, West Bengal, India

Introduction: Prevention on draining of excess water from tank or any other water storing sources after getting filled up has been a problem of common interest in both general household and other public sectors. On the ongoing focus of preservation of drinking as well usable water, this problem itself has its own small but significant appearance. Owing to the rapid advancement in the sensor-technology in last few decades, it is not a matter of great burden though. However, an attempt has been adopted to solve the same from a very basic point of view in the current work. Real time functioning of the model that has been developed as the part of the work shows that its prevalence is within acceptable satisfactory level and suggests it can also be in the field where there is a need.

Since the problem in hand required a two way flow of control, we need a close controlled loop. This phenomenon has been demonstrated in Figure 1 (a). However, the main question is how to complete the loop through the water body that is within the tank, as it is well known that water is poor conductor of electricity. The water body also could not be allowed to carry the same since that water was going to be used finally. Figure 1(b) shows open loop control used in flashes.

Figure 1: (a) Closed controlled loop needed for automatic tank filling, (b) Open controlled loop used in flashes

A possible solution methodology: After a few suggestions and arguments, control part was separated from the main switching mechanism. The coupling between these two was maintained by the buoyancy of water and a properly tuned tension member. The tension member that was taken in developing the model was a simple string. The length of the string is so calculated that it will set a time for evacuating the tank. After a particular time period the pump will start automatically by completing the Relay Circuit and main Circuit. The free ring in one end of the link will help to connect the relay circuit. So, in a nutshell the developed model may be claimed to be an electro-mechanical device.

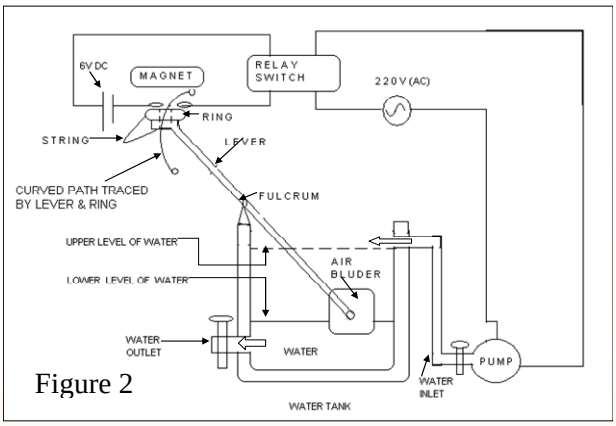


Figure 2

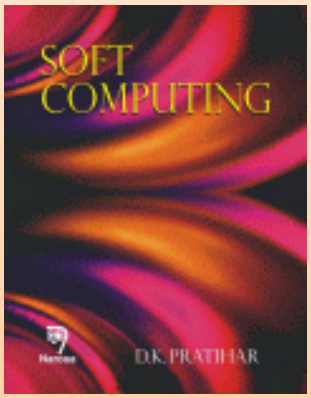
A short description of the model: In order to resemble a real water storing source a tank of given dimension was taken. A lever was used as a switching link, whose one end was fit with a bladder. Other end of the same was attached with a ring which traces two extreme points of the control unit. For the sake of greater smoothness the lever was made to move through a hinge fitted with the tank. The correspondence between the control loop circuit and the main pump-motor circuit was made possible using a relay switch. When the water level falls below the mark of lower level (Figure 2), ring will complete the relay circuit and pump will start functioning. The pump will continue running till then the electrical circuit breaks. A magnet is placed near the ring and a string is connected between the ring and the lever. When the electrical connection is on, magneto motive force will be generated on the ring, as a result it will be in touch with the circuit. On the other hand, as the other end of the lever rises up, the string will be stretched and tension on the string will increase. The circuit will be broken when tensile force of the string increases the magneto-motive force. As a result of which relay circuit will be broken and pump will stop.

Conclusion and future scope of work: The proposed model worked well when fitted with a pump with ratings which are generally used in household. For betterment of the model, one can consider a spring in place of the string as a properly tuned tension member.

Book Review

Review Report

SOFT COMPUTING
D.K. Pratihar



This well-organized book on "Soft Computing" provides introduction to a consortium methodologies underling Soft Computing, a partnership of techniques in the field of modern Artificial Intelligence (AI), which plays vital roles in the conception, design and application of intelligent systems. The constituent methodologies covered in this book include Genetic Algorithms (GA), Fuzzy Logic (FL) and Fuzzy Clustering, Artificial Neural Networks (ANN) and several hybrid techniques, such as GA-FL, GA-ANN, Neuro-Fuzzy, GA-FL-NN etc. The methodologies have been discussed through step-by-step illustration of the algorithm with a number of work-out numerical examples.

The book has been written in a comprehensive and concise manner. The concept of each topic has been explained in lucid manner and overall presentation of key terms and flow of topics are very good. The practical applications, demonstration of the potential of the methodologies have been chosen from diverse disciplines of Engineering. Moreover, end-of-chapter exercises are provided to reinforce understanding of the algorithm presented, and to equip the reader with hands-on programming experiences for problem solving. This could be one of the fundamental textbooks for courses in Soft Computing at both the undergraduate and post graduate levels. It could also be of interest to researchers desirous of applying Soft Computing techniques to their respective fields of work. In my opinion, this book is a well- written textbook on Soft Computing out of all available related books in India and Abroad.

Shibendu Shekhar Roy, Assistant Professor, Dept. of Mechanical Engineering, National Institute of Technology, Durgapur

Industry Watch (Coordinated by Dr. Prasad Bhangale, John Deere Technology Center, Pune)

Dual Clutch Transmission

Use of manual and automatic transmissions in automobiles is well known and been around for long. But there is also something in between known as dual clutch transmission (DCT), which offers the best of the both. It's also known as semi-automatic transmission or clutch-less manual transmission.

In a conventional manual transmission, there is not a continuous flow of power from the engine to the wheels. Instead, power delivery changes from on to off to on during gearshift, causing a phenomenon known as "shift shock" or "torque interrupt." With an unskilled driver, this can result in passengers discomfort as gears are changed.

The dual-clutch gearbox uses two clutches and sophisticated electronics and hydraulics controls to operate them instead of the clutch pedal. The clutches operate independently as one clutch transfers power through the odd gears (first, third, fifth and reverse), while the other using the even gears (second, fourth and sixth). Using this arrangement, gears can be changed without interrupting the power flow from the engine to the transmission.

A two-part transmission shaft is used in DCT, where the odd and even gears are split up on two different shafts, the outer hollow shaft and the inner shaft. The outer hollow shaft feeds second, fourth and reverse gears, while the inner shaft feeds first, third and fifth. Then the first clutch mounted on inner shaft controls first, third and fifth gears, while second clutch mounted on outer hollow shaft controls second, fourth and reverse gears. This allows lightning-fast gear changes and keeps power delivery constant. A standard manual transmission can't do this because it must use one clutch for all odd and even gears.

With gear shifts taking just a few milliseconds, the DCT is considered to offer the most dynamic acceleration for any vehicle. Many automotive OEMs are interested in DCT; however its use is still limited to racecars and high-end passenger cars due to higher cost.

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Forthcoming Events

IPRoMM 2010
Industrial Problems on Machines and Mechanisms
Jaipur

National Conference on Industrial Problems on Machines and Mechanisms

(IPRoMM-2010)

December 17-18, 2010

organized by

Department of Mechanical Engineering
Malaviya National Institute of Technology
Jaipur, India
in association with

Association for Machines and Mechanisms

About Conference

The National Conference on Industrial Problems on Machines and Mechanisms (IPRoMM) is a series of national conferences organized biannually under the aegis of Association for Machines and Mechanisms (AMM), an affiliate of the International Federation for Promotion of Mechanism and Machine Science (IFToMM), on different themes of interest of Industrial Problems on Machines and Mechanisms. The 10th IPRoMM is being organized by the Department of Mechanical Engineering, Malaviya National Institute of Technology Jaipur (Rajasthan), India.

IPRoMM-2010 aims at bringing together the experts in the country on a common platform to speak and outline their vision on the frontier research activities in the area of problems on Machines and Mechanisms. Another major goal is to promote academic-industry interaction and foster collaboration. This conference will consist of several key-note lectures and contributory paper presentations by the eminent researchers and experts from academia and industry.

Handicrafts sector is highly unorganised and the most neglected by researchers. To draw attention of researchers towards this unorganised sector, theme of this conference is chosen as Design and Development of Tools and Equipment for Handicrafts Sector.

Last Date of Registration: **1st December 2010**

For more details and updates see conference website:
www.ipromm2010.org

Forthcoming Events

International Conference On Multi Body Dynamics

(ICMBD – 2011)

February 24-26, 2011

Organized By

KL University (KONERU LAKSHMAIAH EDUCATION FOUNDATION)

29-36-38, Museum Road, Governor Pet
Vijayawada - 520 002, Andhra Pradesh, INDIA

Web Link: *www.kluniversity.in/icmbd-2011*

Co-Sponsored by AMM, The Vibrations Institute of India, Altair Engineering

Students International Olympiad

On

MECHANISM AND MACHINE SCIENCE

April 19-21, 2011

Izhevsk, Russia

Izhevsk State Technical University (ISTU)

The problems on the following topics will be proposed at the Olympiad:

1. Structural analysis and synthesis of mechanisms
2. Kinematics of flat mechanisms
3. Force analysis of mechanisms
4. Kinematic analysis of cam mechanisms
5. Gearings (kinematics, geometry, efficiency)
6. Adjustment of dynamic characteristics, mechanical governors
7. Balancing of rotating masses

The trial problems for the Olympiad, SIO Regulations, information about ISTU, accommodation and transportation details can be found at http://siomms.istu.ru.

International Symposium on Multibody Systems and Mechatronics MuSME 2011

Valencia, Spain, 25 Oct 2011 - 28 Oct 2011

Webpage: www.musme2011.upv.es

Description: The aim of the Symposium is to bring together researchers from the broad ranges of disciplines referring to Multibody Systems and Mechatronics, in an intimate, collegial and stimulating environment. MuSMe 2011 Symposium is one of the activities of the FeIbIM Commission for Mechatronics and IFToMM Technical Committees for Multibody Dynamics and Robotics & Mechatronics. The Symposium will be held at the Escuela Técnica Superior de Ingeniería del Diseño of the Universidad Politécnica de Valencia.

Forthcoming Events

Indo-US Workshop on Fabrionics' 2010

Science of Advanced Fabrication

Workshop Dates: 17-18 December 2010
Tutorial: 20-21 December 2010

The conference will focus on fabrication, structures and properties at micro-nano scales: soft materials, self-organization and novel functionalities

Venue: MGM's Jawaharlal Nehru Engg. College, N-6 CIDCO, Aurangabad

Organisers:
IIT (Kharagpur), IIT (Kanpur), BESU Shibpur, CSIR, IUSSTF and MGM Engineering Institutions
Email: indous2010@gmail.com